DRAFT

Sheep Creek Vegetation Management Project

Fish and Aquatic Species Report and Biological Evaluation

May 2021

Sarah Brandy, Fisheries Biologist
Wallowa-Whitman National Forest
La Grande Ranger District
3502 Highway 30
La Grande, OR 97850
541-962-8590
sbrandy@fs.fed.us

Fisheries and Aquatic Resources

Introduction

The Sheep Creek Vegetation Management Project (Sheep Project) proposes to reduce fuels loading, improve forest health through vegetation management and increase public and firefighter safety. A complete project description including maps is found in the Fuels and Silviculture Report and is not repeated here. This report will disclose the expected effects of the Sheep Project to fish and aquatic species their habitats, and whether they are likely to accumulate with effects of past and reasonably foreseeable future projects overlapping in time and space.

Projects and land management activities on the Wallowa Whitman National Forest (WWNF) are reviewed and evaluated to determine how they may affect aquatic species listed under the Regional Forester's Sensitive Species List, as required under the National Forest Management Act (NFMA). National Forest Service policy for Endangered Species Act (ESA) and Regional Forester's Sensitive listed species is stated in Forest Service Manual (FSM) 2670 and U.S. Department of Agriculture Regulation 9500-4. Three fish species listed as threatened under ESA occur in the two subwatersheds in the Sheep project area.

Historic and current conditions of watersheds and riparian areas directly influence current quality and quantity of aquatic biotic resources and habitat. Hydrology and soils are the basis of evaluation of watershed and riparian function and condition. This fisheries and aquatics report tiers to physical science information provided in the Sheep Project hydrology and soils report as well as conditions of fish and aquatic habitat.

This fish and aquatic resource report analyzes activities proposed in Riparian Habitat Conservation Areas (RHCAs) within the project boundary.

Analysis Framework: Statute, Regulatory Environment and Forest Plan Consistency

Forest Service Manual 2600 Threatened, Endangered and Sensitive Species

Responsibilities described in FSM 2600 are implemented through the Threatened, Endangered and Sensitive Species Programs. The primary objectives of the Threatened, Endangered and Sensitive Species Programs are to recover federally listed and proposed species and meet other requirements of the ESA. The primary objective for Regional Forester Sensitive species is to ensure that actions do not contribute to a loss of viability or cause a significant trend toward listing under the ESA. The effects of any action authorized, funded, or carried out by the Forest Service on a federally listed or proposed, or Regional Forester Sensitive species is analyzed in a Biological Evaluation (Region Six Letter of Direction "Update of the Regional Forester's Special Status Species List" (RFSSSL) February 25, 2019).

There are three fish species listed under the ESA in the project area: Snake River Basin Summer Chinook, Snake River Basin Steelhead and Columbia River bull trout. Species in the project area listed in the Regional Forester's Special Status Species List (see Aquatic Biological Evaluation below). This report is considered the Fisheries Biological Evaluation and Specialist Report which satisfies all requirements of the Biological Evaluation required for the Sheep Creek Project. ESA consultation began August 2019 and was completed (Not completed as of Aug 06, 2021). The Biological Assessment and Biological Opinion will be in the project record when completed.

National Forest Management Act

The NFMA requires National Forests to "provide for a diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet multiple-use objectives." NFMA provides specific direction for managing aquatic resources include standards and guidelines to protect and enhance water quality and quantity, fisheries, aquatic habitat and riparian areas. Wallowa-Whitman Forest Plan information is provided in Table 1.

Table 1. Wallowa-Whitman Forest Plan Compliance Fish and Aquatic Habitat

Forest Plan Subject Summary and Reference	Compliance in Sheep Creek Veg Project Achieved By
Maintain or enhance riparian areas to maintain or improve fish habitat (p. 4-22)	• Design BMPs and PDFs to prevent degrading water quality, fish, or aquatic resources. Silvicultural prescriptions, harvest schedules, logging systems and fuels treatments should be designed to protect aquatic species.
Give management and enhancement of fish habitat priority over other uses described or implied in all other management standards and guidelines (p. 4-22)	• Prevent degrading of water quality, fish, or aquatic resources. Standards and Guidelines should be integrated into project design by following the conservation strategy and requirements of PACFISH/INFISH.

In 1995 the Wallowa-Whitman Forest Plan was amended by the Decision Notice "Interim strategies for managing anadromous fish-producing watersheds in Eastern Oregon and Washington, Idaho, and portions of California, PACFISH (USDA and USDI 1995a) and Interim Strategies for Managing Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana and portions of Nevada "Inland Native Fish Strategy" (INFISH) (USDA and USDI 1995b). The goal of these conservation strategies is to ensure the viability of anadromous and inland native fish that occur on National Forests. Projects implemented under PACFISH/INFISH must meet its goals, Riparian Management Objectives (RMOs) and Standards and Guidelines (S&Gs). PACFISH/INFISH RHCAs are areas where riparian-dependent resources receive primary emphasis. These areas are adjacent to stream channels and wetlands. PACFISH/INFISH riparian goal number one, five, and six are most applicable to the Sheep Creek Project:

- PACFISH/INFISH Riparian Goal 1 – Maintain and restore water quality, to a degree that provides for stable and productive riparian and aquatic ecosystems.
- PACFISH/INFISH Riparian Goal 5 – Maintain or restore diversity and productivity of native and desired non-native plant communities in riparian zones.
- PACFISH/INFISH Riparian Goal 6 – Maintain or restore riparian vegetation, to:
  A) Provide an amount and distribution of large woody debris characteristic of natural aquatic and riparian ecosystems.
  B) Provide adequate summer and winter thermal regulation within the riparian and aquatic zones; and
  C) Help achieve rates of surface erosion, bank erosion, and channel migration characteristic of those under which the communities developed.

Forest Plan PACFISH/INFISH RMOs and stream survey data for the project area that shows what current fish habitat conditions are compared to RMOs are detailed in the fish and aquatic resources existing conditions report in the Project Record.

PACFISH/INFISH Standards and Guidelines relevant to the Sheep Project include:

Timber Management

TM – 1 Prohibit timber harvest, including fuelwood cutting, in Riparian Habitat Conservation Areas, except as described below.

a. Where catastrophic events such as fire, flooding, volcanic, wind, or insect damage result in degraded riparian conditions, allow salvage and fuelwood cutting in Riparian Habitat Conservation Areas only where present and future large woody debris are met, where cutting wood would not retard or prevent attainment of other Riparian Management Objectives, and where adverse effects on listed anadromous and inland native fish can be avoided. For watersheds with listed salmon or designated critical habitat, completed Watershed Analysis prior to salvage cutting in RHCAs.

b. Apply silvicultural practices for Riparian Habitat Conservation Areas to acquire desired vegetation characteristics where needed to attain Riparian Management Objectives. Apply silvicultural practices in a manner that does not retard attainment of Riparian Management Objectives and that avoids adverse effects on listed anadromous fish and inland native fish.

Fire/Fuels Management

FM-1 Design fuel treatment and fire suppression strategies, practices, and actions so as not to prevent attainment of Riparian Management Objectives, and to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuel management actions could perpetuate or be damaging to long-term ecosystem function, listed anadromous fish, or designated critical habitat, or inland native fish.

FM-4 Design prescribed burn projects and prescriptions to contribute to the attainment of the Riparian Management Objectives.

Forest Plan Riparian Habitat Conservation Areas

Riparian Habitat Conservation Areas

The role of large and small living and dead trees for healthy riparian function and contribution to aquatic habitat is well documented (Pollock and Beechie 2014, Frissell et al. 2014). As stated in the Biological Opinion for Lower Joseph project on the Wallowa-Whitman National Forest "Such functions [of large and small wood] include but are not limited to carbon storage, retention of nutrients and sediment, creation of essential habitat for numerous aquatic and riparian-dependent species, regulation of temperature, and maintaining moist, microclimate that can slow the movement of wildfires….Large and small riparian trees that die and fall into and near streams, floodplains, and wetlands: (1) Regulate sediment and flow; (2) sort and store sediment and nutrients; (3) influence stream channel complexity and stability; (4) increase pool volume and area; and (5) provide hydraulic refugia and cover for fish (Biological Opinion NOAA NMFS No.: WCR-2015-2460).

Effects to riparian and aquatic habitat is minimized by restricting management activities in RHCAs (USDA USDI 1995a, 1995b). RHCA widths for the Sheep Project are displayed in Table 2. RHCA boundaries are estimated in GIS for planning and analysis purposes. These areas are measured in linear feet from the streambanks. RHCAs are delineated on the ground during layout activities for vegetation treatments.

Table 2. Definitions of PACFISH/INFISH Category, Forest Plan Stream Class and RHCA Widths in linear feet

Definitions and RHCA Width	Fish Bearing	Permanently Flowing and non-Fish Bearing	Ponds, lakes, reservoirs, and wetlands > 1 acre	Seasonally flowing or intermittent streams, wetlands < 1 acre, landslides, and landslide-prone area
PACFISH/INFISH	Category 1	Category 2	Category 3	Category 4
Forest Plan	Class I, II	Class III	N/A	Class IV
RHCA Width	300’	150’	150’	100’

RHCA widths may be adjusted based on a watershed analysis (USDA USDI 1995a, 1995b). A watershed analysis was completed for the Grande Ronde River Watershed in 1997. This analysis did not identify or recommend adjustments of RHCA widths, therefore standard PACFISH/INFISH (1995) RHCA widths are used for this project.

Management Indicator Species

Management Indicator Species (MIS) are “species selected because its welfare is presumed to be an indicator of the welfare of other species using the same habitat…” (Wallowa-Whitman Land and Resource Management Plan, 1990). Habitat on the WWNF are managed for MIS species. Steelhead trout and redband trout *Oncorhynchus mykiss (O. mykiss*) are MIS species present in the project area.

Existing conditions of habitat for MIS species in the project area can be found in the Fish and Aquatic Habitat Existing Conditions report for Sheep Vegetation project.

See Management Indicator Species section of this report for effects from proposed management activities in alternatives 2 and 3.

Aquatic Biological Evaluation

This fisheries and aquatic resources report satisfies requirements of Forest Service Manual 2672.4 requiring the Forest Service to review all planned, funded, executed or permitted programs and activities for possible effects on proposed, endangered, threatened or sensitive species by completing a Biological Evaluation (BE). The Region 6 Regional Forester Special Status Species List was last updated in February 2019. The BE process is intended to review the Sheep Creek Project in sufficient detail to determine effects of alternatives on species in this evaluation and ensure proposed management actions would not contribute to the loss of viability for species listed as sensitive by USDA Forest Service, Region 6, or any native or desired, non-native species; nor cause any species to move toward federal listing (FSM 2672.4).

The following sources were used during the pre-field review phase to determine the presence or absence of aquatic PETS species in the effects area for the Sheep Project:

- Wallowa-Whitman N.F. GIS database
- Regional Forester's (R6) sensitive animal list (February 2019)
- ODFW stream survey and fish survey reports
- Forest Service stream survey reports, Wallowa-Whitman NF, La Grande, OR
- Oregon Natural Heritage Program (ORNHP) database
- Natural Heritage Conservation database (Biosource)
- Oregon Native Fish Status Report (2005)

See Aquatic Biological Evaluation section of this report.

Analysis Area

Methodology

Analysis Method

- Stream surveys reviewed and aquatic habitat assessed
- Mapped known fish and aquatic species and describe potential distribution, ESA listed species, Regional Forester Special Status Sensitive Species, and Management Indicator Species (aquatic species) within Project Area
- Determine potential effects to aquatic species and their habitats, tier to the hydrology physical science report for effects to water quality
- Evaluate consistency with Forest Plan aquatic conservation strategy and PACFISH/INFISH.

Affected Environment

The Affected Environment for this analysis is the areas where direct and indirect effects could occur to fish and aquatic habitat and fish and aquatic species. This includes stream channels, streambanks, surface and ground water, floodplains, riparian areas, and riparian vegetation. The project area contains 133 miles of stream networks with 44 miles of Category 1 fish bearing streams, 35 miles of Category 2 perennial, non-fish bearing streams, and 53.5 miles of Category 4, intermittent streams (Table 5 Existing Conditions report in project Record). Springs and wetlands were also defined in the project area and are considered either Category 3 or 4 (see Watershed Resource report for more information on these areas). Species and habitat that occur in the project area and are analyzed in this report are described in this section.

ESA listed Species

Three section 7 ESA listed fish and their critical habitat occur in the project area: Columbia River bull trout, Snake River Basin steelhead and Snake River Basin spring Chinook. All three species are listed as Threatened. See Fish and Aquatic Existing Conditions for ESA listed fish species, distribution, and critical habitat in the project area.

Aquatic Management Indicator Species

The WWNF Forest Plan identifies two fish species as Management Indicator Species (MIS); redband /rainbow trout and steelhead (USDA 1990). These species are considered good indicators of maintenance and quality of instream habitat. Habitat where these fish occur is considered high quality water and fish habitat. Resident redband trout and anadromous steelhead occur in the project area. There are 27.3 miles of redband trout habitat and 20 miles of designated critical habitat for steelhead in the project area. See Existing Conditions for Fish and Aquatic resource report for redband trout and steelhead distribution and habitat conditions.

The NFMA regulations require that "fish and wildlife habitat be managed to maintain viable populations of existing …species in the planning area." To ensure that these viable populations are maintained, the Pacific Northwest Region of the Forest Service has identified management requirements for a number species within the region. These Management Indicator Species are emphasized either because of their status under ESA or because their populations can be used as an indicator of the health of a specific type of habitat (USDA 1990).

Riparian ecosystems important to fish and aquatic species occur at the margins of standing and flowing water, including intermittent stream channels, ephemeral ponds, and wetlands. The aquatic MIS were selected to indicate healthy stream and riparian ecosystems across the landscape. Attributes of a healthy aquatic ecosystem includes: cold and clean water; clean channel substrates; stable streambanks; healthy streamside vegetation; complex channel habitat created by large wood, cobbles, boulders, streamside vegetation, and undercut banks; deep pools; and waterways free of barriers. Healthy riparian areas maintain adequate temperature regulation, nutrient cycles, natural erosion rates, and provide for instream wood recruitment.

MIS effects analysis is on page 21 of this report.

Regional Forester's Aquatic Special Status Sensitive Species List

This aquatic specialist report satisfies requirements of Forest Service Manual 2672.4 requiring the Forest Service to review all planned, funded, executed or permitted programs and activities for possible effects on proposed, endangered, threatened or sensitive species by completing a Biological Evaluation (BE). The Region 6 Regional Forester Special Status Species List was last updated in February 2019. The BE process is intended to review the Sheep Creek Project in sufficient detail to determine effects of alternatives on species in this evaluation and ensure proposed management actions would not:

- likely jeopardize the continued existence, or cause adverse modification of habitat, for a species that is proposed (P) or listed as endangered (E) or threatened (T) by the USDI Fish and Wildlife Service or NOAA National Marine Fisheries Service; or
- contribute to the loss of viability for species listed as sensitive (S) by USDA Forest Service, Region 6, or any native or desired, non-native species; nor cause any species to move toward federal listing (FSM 2672.4).

Sources used during pre-field review to determine presence or absence of aquatic PETS species in the effects area for the Sheep Creek Project are listed in the Fish and Aquatics Existing Conditions report.

Two species on the Regional Forester's Sensitive Species List for the Wallowa-Whitman National Forest have confirmed occurance in the proejct area; Redband trout and Pacific lamprey are and occurance is confirmed in the project area. Pacific lamprey have been translocated into the upper Grande Ronde River mainstem since 2017 and Sheep Creek in 2018 (82 adults) and 2019 (209). Spawning lamprey and redds were oberved in Sheep Creek in 2019 and 2020. No other aquatic sensitive species have been confirmed in the project area. Because habitat in the project area is suitable for Western Ridged Mussel, they will be treated as if they were present. See Existing Conditions for Fish and Aquatic resource report for more information on Regional Foresters Aquatic Sensitive Species List for the Sheep Creek project area.

Stream Habitat Conditions

The Sheep Creek and Chicken Creek subwatersheds have been the focus of substantial amounts of fish habitat and meadow/floodplain restoration in the Upper Grande Ronde River Basin. Passive and active restoration work have occurred in Sheep Creek and tributaries to Sheep Creek, Chicken Creek, West Chicken Creek, Dry Creek, and tributaries. Fish habitat and hydrology has improved in these reaches and is on a trajectory to meet several riparian management objectives at the reach scale. Existing stream habitat conditions are described in the Fish and Aquatic Habitat Existing Conditions report and are incorporated by reference into this report. Pool frequency, large wood (LWD) numbers, and width to depth ratios meet RMOs on several fishbearing streams in recent surveys or have shown improvement from early surveys in the 1990s.

Five locations have stream temperature data in the project area. The Oregon Department of Environmental Quality (ODEQ) state water quality standard is based on the maximum 7-day running average, Maximum Weekly Average Temperature (MWAT). Temperature standards were developed based on temperature requirements of salmonids during different seasons and life stages. There are two temperature standards that apply to streams within the Sheep project area; water bodies must not be warmer than 60.8°F for core cold water habitat and water bodies must not be warmer than 53.6 for bull trout spawning and rearing habitat. In 2014 and 2017 eDNA samples were collected to verify bull trout presence in Sheep Creek, East Sheep Creek, and Chicken Creek. Results were positive for Chicken Creek and negative for Sheep and East Sheep Creek (USFS 2021). However, because ODEQ's 2018/2019 Integrated Report identifies designated fish use of East Sheep Creek as Bull Trout Spawning and Juvenile Rearing, this analysis tiers to that report. Indiana Creek is also known bull trout spawning and rearing habitat. The 53.6 degree temperature standard applies to Chicken Creek, West Chicken Creek, East Sheep Creek and Indiana Creek and the 60.8 degree standard applies to the rest of the fish bearing streams in the project area. Sheep Creek has exceeded 60.8 degrees each year from 2010-2020. East Sheep has 2 years of monitoring. The temperatures standard was exceeded in 2019, but not 2020. Chicken Creek, West Chicken Creek, and Indiana Creek have exceeded the 53.6-degree standard in all years monitored (Chicken Creek 2010-2020, West Chicken 2010-2020, and Indiana Creek 2017-2020. West Chicken has been below 60.8 2008-2019. West Chicken was not sampled for bull trout, but it is likely that bull trout use West Chicken Creek. If bull trout are confirmed there, the standard would be 53.6 and West Chicken has exceeded that threshold all 12 years of monitoring. See the Hydrology Resources Report for more information including ODEQ 303(d) listed streams.

Road Stream Crossings

There are 331 stream crossing in the project area including 33 crossings on fish bearing streams. Ten of these do not meet standards for fish passage. There are varying degrees of quantity and

quality of habitat upstream of these barriers. Additionally, there is one culvert considered "gray." More information is needed to determine if this culvert is meeting fish passage standards or not.

Total road density, including open and closed roads, is high; 5.06 mi/mi² in Sheep Creek subwatershed and 4.39 mi/mi² in Chicken Creek subwatershed. A substantial amount of road work has been completed in the past 5 years in the Sheep and Chicken Creek subwatersheds including replacement of five culverts to structures suitable for fish and aquatic organism passage. In addition, the 5184 road adjacent to Sheep Creek was improved with drainage structures, resurfacing, and ditch relief to improve hydrologic flow connectivity.

Actions proposed in Riparian Habitat Conservation Areas

Two types of activities are proposed in alternative 2 and 3 in RHCAs: vegetation activities and road activities.

Project development included consideration of treatments that would meet the forest plan by applying silvicultural practices with the primary objective to acquire desired vegetation characteristics in RHCAs. Field work by silviculture and fisheries included looking at riparian stands that have existing hardwoods and considering treatments that would improve condition and health of those desired vegetation communities. Objectives developed for thinning in RHCAs include:

- Restore resilient forest structure
- Maintain shade on existing streams
- Restore large diameter trees in riparian areas that lack large trees for future large woody debris recruitment
- Promote broadleaf species (cottonwood, alder, and willow) where they exist and established broadleaf species.

See Silviculture Resource report for detailed information on these objectives.

Thinning and harvest activities were designed around Blue Mountain Province Expedited Process Instrument II for Programmatic Informal Consultation with Project Design Criteria for Federal Land Management Activities Affecting ESA and MSA Listed Animal and Plant Species (Blue Mountain PDCs (2013 as amended in 2015). Additional project specific Project Design Criteria (PDC), were developed for this project to mitigate for ground disturbance and negative effect to soils and water resources in RHCAs. See full suite of project design criteria pages 23-35 Sheep Creek Vegetation Management Preliminary EA.

Blue Mountain PDCs are applied in Alternative 2 and 3 to meet objective 2 for this project described above. In addition PDC SQ-9 RHCA Treatments for soils for Commercial RHCA treatments; where equipment will stay on existing roads and total suspension to remove select trees was designed for this project. Non-commercial treatments in RHCAs will be hand thin only. See Management Requirements, Constraints and Mitigation Measures for SQ-9, SQ-14.

Environmental Impacts

This report uses existing fish and aquatic habitat conditions and analyzes the effects of proposed activities on fish and aquatic species and habitat. The analysis area for this report is the same geographic area as the project area. There are no effects to fish and aquatic resources anticipated to reach areas downstream of channels in the project area from proposed activities.

Indicators and Measures for fish and aquatic resources

Indicator	Measure
Water Quality	Stream temperature, turbidity levels (sediment)
Fish and Aquatic Habitat	Large wood, pool frequency, channel, and bank stability

Indicators used to determine effect in this analysis are water quality and fish habitat. For the indicator water quality, units of measure are stream temperature and turbidity (inputs of fine sediment). Indicators and measures are derived from PACFISH/INFISH RMOs. For the indicator fish habitat, units of measure are number of pieces of large wood per mile, number of pools per mile, and stream channel and bank stability (measured as a percentage of stable streambank). For this analysis the measure for these are a change from existing conditions, for example increase in water temperature, and increase or decrease in large wood counts. This report tiers to and references the Hydrology report for water quality indicators.

In general, direct effects to fish and water resources are related to sediment input from actions that occur at the same time and place as these resources, for example activities that occur in the stream channel. Indirect effects are primarily related to impacts which are caused by an action where effect occurs later in time or farther removed in distance from fish and water resources. Cumulative effects occur from present and reasonably foreseeable future actions that overlap in time and space with the effects of the Sheep project. Time frames for the direct/indirect effects analysis for fish and aquatic habitat are short term (immediate to 5 years) and long term (5-20) years.

Other effects disclosures include: Aquatic MIS, and Aquatic PETS (proposed, endangered, threatened, and sensitive) species under Biological Evaluation in this document.

Summary of RHCA Activities and Effects

Direct and indirect effects to fish and aquatic resources that would occur from project activities are limited to activities that occur within RHCAs. Activities such as fuels treatments, thinning, and timber harvest that occur outside of RHCAs will not be analyzed in this report.

Direct effects to fish and aquatic species and fish habitat are limited to activities that occur in stream channel(s) or on the banks of stream channels. The only activities in the Sheep project that occur in the stream channel are installation, replacement, and removal of road stream crossing structures.

- Replace 2 culverts that do not meet standards for Aquatic Organism Passage, one is on Sheep Creek and one is on East Fork of Sheep Creek.
- Remove 2 structures on closed roads that are barriers to fish passage

All other activities that occur in RHCAs are analyzed as indirect effects to water quality, fish, and fish habitat.

Indirect effects to fish and aquatic resources could occur from the following activities due to their proximity to aquatic species and their habitat:

- Commercial harvest in RHCA HTH units (Alternative 2) 261 acres (15of total would be commercial harvest)
    - Category 1 192 acres
    - Category 2 37 acres
    - Category 4 51 acres
- Non commercial hand thinning in RHCA Wetland Unit 36 acres (Alternative 2 and 3)
- Road maintenance in RHCAs (Alternatives 2 and 3)

Non-commercial hand thinning activities in RHCAs (RHCA PDC) that have no effect on fish and aquatic species and habitat:

- Hand thinning, hand piling, and fuels treatments in RHCAs following Blue Mountain Project Design Criteria (PDC) (1,118 acres Alternative 2 and 875 acres Alternative 3)

Non-commercial hand thinning and hand piling for fuels treatments follow Blue Mountain PDCs. These activities, common to land management and with predictable outcome for effects, were analyzed in the Biological Assessment for USDA Forest Service (Malheur, Wallowa-Whitman and Umatilla National Forests) and USDI Bureau of Land Management (Vale and Prineville Districts) (USDA, USDI 2013 as amended in 2015). This analysis found that activities meeting design criteria as outlined in the BA were Not Likely to Adversely Affect (NLAA) ESA listed and proposed species and designated Critical Habitat and Not Adversely Affect (NAA) MSA Essential Fish Habitat. These activities will not be further analyzed in this document.

Vegetation Treatments

There are no direct effects to fish and aquatic species or habitat from vegetation treatments in either alternative because no vegetation treatments would occur in stream channels or on the banks of streams. No treatments would directly effect any indicator or measure. Vegetation treatments in RHCAs occur in three categories: wetland/meadow enhancement, commercial harvest, and non-commercial thinning for stand health and fuels reduction. As stated above, non-commercial hand thinning (RHCA-PDC) will have no effect on indicators and measures and will not be further analyzed. Effects can be found in Blue Mountain PDCs (2013, as amended in 2015).

This section analyzes indirect effects of vegetation treatments proposed within RHCAs; commercial harvest in alternative 2, and hand thinning in a 36-acre unit Category 1 RHCA along Sheep Creek in alternatives 2 and 3.

RHCA Meadow Restoration

ALTERNATIVE 1 – NO ACTION

Lodgepole and other conifer trees are actively encroaching the high terrace/historic floodplain next to the entrenched stream channel along Sheep creek. This advancement of dryer species would likely continue in this 36-acre unit. Because of all the restoration efforts in Sheep Creek in this area, including aggrading the stream channel to restore elevational connection to the floodplain, we expect some conifers in the meadow to naturally die. Snags would consequently fall on the floodplain and meadow and dissipate and aid water storage especially during spring storm run-off flows.

ALTERNATIVE - 2 AND 3

Young, small diameter (understory) conifers encroaching open meadow habitat in the 36 acre meadow restoration unit, Sheep Creek floodplain would be thinned and left on the ground in alternatives 2 and 3. The Sheep Creek floodplain, including this meadow system, became a simplified, entrenched channel that lost elevational connection to its floodplain when the energy of the channel down cut the channel, essentially becoming a ditch. The floodplain terrace became high and dry compared to the elevation of the streambed. Because the conditions of the floodplain changed (drier) species that are not adapted to wetland and floodplain conditions, such as lodgepole pine, became established. Effort to restore fish habitat and floodplain in Sheep Creek has helped the system to aggrade and connection to the floodplain has improved. Restoration efforts included planting deciduous hardwoods, and building/reconstructing elk and livestock exclosure fence to help plantings get established and prevent livestock trampling of banks.

The main objective in this unit is to promote establishment, growth, and cover of cottonwood, willow, sedge and rush communities, and other native deciduous vegetation. This would be achieved through removing young conifers in the open meadow adjacent to Sheep Creek. Trees that would be thinned include lodgepole pine, and grand fir. On addition to native hardwoods, species favored in this treatment to thrive and become more vigorous include western larch, Engelman spruce, ponderosa pine and Douglas fir particularly in the outer RHCA outside of the floodplain. No trees that actively produce shade would be removed in this unit. Only understory trees <12-inch DBH that are 50 feet or father from streambank would be thinned and left on the floodplain to leave roughness and nutrients and to assist in retaining water on the floodplain during spring run-off and high flows.

ESA listed species and critical habitat are present, significant instream restoration has occurred including several years of riparian vegetation planting. Thinning of lodgepole pine and upland species that have encroached on this meadow due to an entrenched simplified stream channel and drop in water table and disconnected floodplain is expected to assist in desired riparian species recovery including native hardwoods, sedges and rush communities. Trees will be thinned throughout the floodplain and near the steam channel in this unit. Trees will be thinned Dense conifer shade was not historical in this montane meadow setting.

Effects to Indicators and measures

Indicator: Water Quality

Measure: stream temperature

In alternative 2 and 3, young conifers that are not actively producing shade on Sheep Creek would be selected for thinning to avoid affecting stream shade and risk of increase in solar radiation to the stream, which could affect stream temperature (Wondzell, 2019). A 50 feet buffer from the edge of stream out across the floodplain would not be thinned. This thinning treatment deliberately retains shade producing trees. Because this thinning selects young, understory conifer, and because this thinning occurs on .05% of all Category 1 RHCA in the Sheep Creek subwatershed, there would be no measurable effect to stream temperature in the short term from this thinning. The purpose of this treatment is to restore the health and vigor of native deciduous vegetation in the long term. In addition, Reeves et al (2016) found that adequately sized and stocked riparian areas could offset the potential effects of climate change on water temperature, this could provide long term benefits to Sheep Creek.

Measure: turbidity/sediment levels
There would be no effect on sediment. There would be no ground disturbance since this is hand thinning treatments and trees that are thinned would be left on the ground as cover and would be obstructions that would encourage background levels of sediment to settle out on the floodplain instead of entering the creek by overland flow.

Indicator: Fish Habitat

Measure: large wood
Short term effects are increased down wood from thinned trees across the floodplain and meadow. Increased growth of trees retained in riparian areas are expected to improve future sources of large wood (Rentmeester 2004). Rentmeester (2004) conducted a thinning study focused on the production of snags as the primary recruitment mechanism along mainstem stream channels. Results indicate that silvicultural thinning resulted in increased diameter growth within residual trees. Faster diameter growth meant that trees were larger when they died and therefore the number of snags above the target diameter were greater. Abundance of large diameter snags increased by 20-74% under thinning scenarios relative to unthinned stands. Indicators and measures are discussed below.

There are no short-term effects to in channel large wood in alternative 2 or 3. There is a long-term beneficial effect for future sources of large wood that are larger in diameter due to thinning in this 36-acre unit. In addition, Dwire, et al. (2016) caution leaving riparian areas untreated when fuels load in surrounding uplands are planned for treatment. Because riparian fuel loads have been influenced by fire suppression and administrative protection policies these areas could be considered hazardous in wildland environments, if left untreated (Dwire et al. 2016).

Measure: pool frequency
There will be no effect to pool frequency or quality of existing pools from meadow restoration in alternative 2 or 3.

Measure: channel and bank stability
There will be no effect on channel and bank stability from meadow restoration in this unit in alternatives 2 or 3. No activities occur in proximity to stream banks.

RHCA Commercial Thinning and HTH

ALTERNATIVE 1 and 3

In alternative 1 and 3 none of the 261 acres of RHCA would have any thinning. This includes the 15% (approximately 42 acres of commercial and See Silviculture report for more information on existing stand conditions).

ALTERNATIVE 2

Commercial Harvest

The objective of this proposed treatment is to restore resilient forest structure through variable retention thinning, thin stands to healthy densities of native species, and reduce surface fuels and overall forest density. The expected outcome would be to shift species composition to fire tolerant species. In addition, reducing competition in residual trees would increase vigor and growth rate, restoring large diameter trees for future large woody debris recruitment. In areas of the unit that are not near the road where commercial harvest would occur, small diameter, understory trees would be hand thinned to reduce fuels and competition for growth.

Stream shade would be maintained by maintaining existing stocking of vegetation adjacent to the stream, retaining large diameter trees, invigorating growth of retained trees for future large wood recruitment, and promoting broadleaf species such as cottonwood, alder, and willow. Treatment was designed on south aspects of drainages to avoid effect on stream shade. Additionally, shade would be maintained on the stream by leaving a minimum of 50 linear feet buffer. Beyond 50 feet, residual stand density would be feathered so that higher levels of stocking would be retained near streams.

Commercial harvest would occur in 15% (approximately 42 acres) of the 261 acres of RHCA and the rest of the acres would be RHCA-HTH, non-commercial thinning treatments. Total commercial thinning treatments would occur on less than 1% of RHCAs in the project area, see Table 3. Full suspension systems would be used to harvest trees from road prisms to avoid ground disturbance in RHCAs. Acres proposed for this treatment were selected where they are adjacent to roadbeds and commercial/non-commercial units, where broadleaf species exist such as willow, alder, and cottonwood exist. Other selection criteria included presence of large western larch, ponderosa pine or Douglas-fir trees.

Conditions of some units proposed for these treatments, such as unit 71 and 68, have higher gradient, densely forested, confined stream channels, with approximately 25 feet of riparian vegetation from the stream edge. In these conditions, the vegetation is mostly alder and some dogwood adjacent to the creek with more abundant vegetation at stream/road crossings where light infiltrates the dense forest.

Table 3 Acres of Affected RHCAs

Stream Category	RHCA acres RHCA HTH units	RHCA acres treated with commercial harvest in RHCA HTH units	Percent treated of total RHCAs in Project Area

Category 1	192	28.8	<1%
Category 2	37	5.6	<1%
Category 4	51	7.7	<1%
Total	261	42	

Effects to Indicators and measures

Indicator: Water Quality

Measure: Stream temperature
Because units were designed so that any thinning of trees in these units would occur on the south facing side of the unit and a minimum of 50 feet would not have any harvest, stream temperatures are not expected to be affected. Canopy cover over the stream channel would not be reduced. See Hydrology report, there would be no direct or indirect effect to stream temperature in Alternative 2 because existing trees are not very tall and therefore most trees beyond 50 feet do not contribute directly to stream shade and there are many trees within the over stocked buffer that currently provide shade.

Measure: Sediment
Because harvest would occur using full suspension logging systems and equipment would be limited to the road prism, ground disturbance from equipment in this unit is not expected. There would be no measurable sediment entering stream channels from this activity. There would be no difference between alternative 1, 2, and 3.

Obstructions in the path (i.e. downed wood, grass/forb cover) between the sediment source and the stream reduce the risk of indirect sediment delivery to the stream. Adequate filter strips (in terms of size, ground cover and downed material) are necessary to slow or prevent sediment movement downslope of disturbed areas. The use of the riparian buffers described above has long been recognized as a mitigation measure to reduce sediment transport to streams. The structural complexity of roots and herbaceous vegetation, in addition to the absorption capability of the duff layer, limits excess sedimentation to the aquatic system. Surface runoff slows down when it contacts herbaceous shrubs, mature trees and the duff layer on the forest floor and sediment is deposited within the riparian buffer before it reaches the watercourse (Decker 2003).

See Hydrology and Soils Report for more information.

Indicator: Fish and aquatic habitat

Measure: Large Wood
There would be no short-term change in large wood recruitment into stream channels because a minimum of 50 feet buffer will be left. Long term effects may result in a beneficial effect of an increase in diameter in trees retained in these stands. Because there would be no effect to large wood quantity in stream channels in alternative 2, there would be no difference in alternative 1, 2, or 3.

Measure: Pools

There would be no effect on pool frequency or quality. There would be no measurable overland sediment from ground disturbance that would contribute to sediment that could settle in or fill pools. Equipment will stay on existing road prisms and not enter undisturbed ground. Additionally, all activities would be a minimum of 50 linear feet away from edge of stream. There is no difference between alternatives1, 2, and 3 for change in quality or quantity of pools.

Measure: Channel and Bank Stability
No change expected due to minimum no activity buffers and no activity on or near stream banks.

Beneficial effects from all thinning treatments:

Long term benefits of thinning dense, young, uniform stands are well documented (Spies et al. 2013). Spies et al found that the greatest potential ecological benefits of thinning to accelerate the development of older forest structure (large trees, large dead trees, spatial structural and compositional heterogeneity, etc.) comes in dense uniform plantations less than 80 years old and especially less than 50 years old. A well-known effect of precommercial, small diameter tree thinning is increased diameter growth of the residual trees caused by the redistribution of the environmental resources among a smaller number of selected trees. When number of stems per hectare is very large, the leaf area of each tree can be very limited, and few carbohydrates are then available for height development. In this scenario, stagnation of growth can occur (Pothier 2002). In a study of tree growth after thinning, Homyack et al. (2004) found that six to 11 years post thinning forest stands had a greater overstory structure than similar untreated stands. In contrast, unthinned stands gained little overstory structure indicating that the application of pre-commercial thinning was responsible for the accelerated height and diameter growth. Increased growth of riparian vegetation could improve. For more benefits of thinning see Silviculture Resource Report.

Fuels Burn Blocks-Alternative 2 and 3

RHCAs
Alternatives 2 and 3, propose burning activities that result in low severity fire in RHCAs in the project area. Burning would occur when fuel moisture levels are high. No active lighting would occur in RHCAs. Fire would back into RHCAs from adjacent upslope areas. Low intensity fires that burn in a patchy distribution would occur in RHCAs. Tree mortality from prescribed fire in RHCAs would primarily be understory trees (≤ 8" dbh). Understory trees of this size typically do not provide stream shade.

Riparian shrubs are not expected to be impacted because of the proposed burning because they are present in the moister riparian areas. Where the above ground portions of riparian shrubs are impacted by fire, they would likely sprout back relatively quickly because the low severity fire would not be hot enough to destroy root crowns.

Due to the low intensity burn in RHCAs, these activities are not expected to effect indicators and measures in either alternative.

Road Activities

ALTERNATIVE 1 – NO ACTION
Sheep Creek and Chicken Creek subwatersheds have high road densities (combined open and closed roads, See Fish and Aquatic resources existing conditions report). There are 331 known

stream crossings in the project area. Ten culverts are confirmed barriers to fish passage. In alternative 1 all barriers and road drainage issues would remain until funding becomes available for replacing barriers and road maintenance.

Road Stream Crossings

ALTERNATIVE 2 AND 3

Six road stream crossings would be removed, and three culverts that do not meet fish passage standards would be replaced with structures designed to meet Aquatic Organism Passage standards in Endangered Species Act -Section 7 Consultation Supplemental Aquatic Restoration Biological Opinion ii (ARBOii) (2013) in alternative 2 and 3, displayed in Table 4.

Table 4 Culvert removals and replacements

FS Road	Stream Name	Proposed action	ESA listed fish and/or Critical Habitat
5100-372	Indiana Creek	Remove old log deck bridge	Yes
5182-034	East Sheep Cr Tributary	Remove	No
5182-035	East Sheep Cr	Remove	Yes
5182-040	East Sheep Cr Tributary	Remove	Not fish bearing
5182-100	East Sheep Cr	Remove old log bridge crossing	Yes
5182-500	Upper Sheep Creek	Replace with AOP	Yes, SRB steelhead and DCH for bull trout
5182-520	Sheep Junior Cr	Remove and replace with trail bridge	Yes
5184-000	Sheep Tributary, lower culvert	Replace with AOP	Yes
5184-000	Sheep Tributary, upper culvert	Replace with AOP	Yes

Additional non fishbearing stream and ditch relieve culverts would be installed on temporary roads and closed roads for roads to be up to standards to be used for project activities. Eleven culverts would be installed on Category 2, 4 streams and GDEs (where there is a spring on the

road) in Alternative 2. One culverts would be installed on Category 2, 4 streams and GDEs in Alternative 3. See Transportation Effects analysis for complete road maintenance and stream crossing installation plan.

Direct Effects

ARBOii (2013) and Forest Service National Core BMPs (USDA 2012) apply to culvert replacements and removals. Following ARBOii and BMPs, such as replacing culverts when flows are low and conditions are dry, temporarily bypass flow around construction, and follow in-water work window guidelines (ODFW 2008), will minimize short term, local effects to fish and aquatic organisms from sediment input and turbidity related to construction and channel work.

Direct effects from these activities would be limited to rewatering the channel through the stream crossing after construction is complete. This would cause an initial pulse of sediment into the channel and increase suspended sediment and turbidity. Effects from increased sediment would be short term and local. Sediment is expected to settle out within 0.5 miles of construction when flows are low (Bilby 1989; Duncan 1987; Foltz et al. 2008; Lachance et al. 2008). Because the channel where work is being conducted will be dry and water will be routed around the site, direct effects are minimized. Fish salvage would occur in the main channel before it is blocked, and water is diverted around it. This would follow fish handling requirements and electrofishing guidelines (NMFS, 2000).

Removal and replacement (upgrading to AOP) would have important short- and long-term beneficial effects to fish and aquatic organisms. These activities would improve access for fish and aquatic organisms to upstream habitat.

Indirect Effects

Effects that could directly effect water quality, discussed above, could cause indirect effects to fish and aquatic organisms or habitat. In addition, in channel work in non-fish bearing channels to install, replace and remove culverts in Category 2 channels (perennial non-fishbearing), could have indirect effects to fish and aquatic organisms, depending on proximity of stream crossing to fishbearing streams downstream.

Alternative 2 would have 11 temporary culverts installed and Alternative 3 would have 1. All stream crossing culvert installations or replacements would occur at low flows or when channels are dry to minimize effects to water quality downstream. Following installation of the temporary culverts, periodic spikes in sediment input are expected during the first winter season in response to precipitation events that may mobilize sediments from disturbed areas. Sedimentation may also occur throughout the site recovery period until fill slopes stabilize (2 to 3 years following installation). An additional spike of sediment input would occur when the temporary culverts are removed after the project is completed.

Culvert installation and removal on perennial, non fishbearing streams (Category 2) or intermittent streams (Category 4) would occur on closed roads and temporary roads. Culvert installation would follow soil and water BMPs and PDCs, activities would occur when flows are low or channel is dry. A sediment pulse could occur when first precipitation event occurs after culvert removal, but this would be short term and localized and not have measurable turbidity increases.

Indicator: Water quality

Measure: stream temperature

No measurable effects are expected on solar input to streams when replacing and removing stream road crossings. There may be limited streamside vegetation cleared/removed where the structure replacement has a larger footprint than the existing structure. Where culverts are removed, there would be daylighting of the stream through the CMP. These effects would be localized and are not expected to effect temperature of streams.

Measure: sediment

Fine sediments are typically detectable up to 0.5 miles downstream from location of culvert replacement and removal projects. (Bilby 1989; Duncan 1987; Foltz et al. 2008; Lachance et al. 2008). Short term effects to fish and aquatic organisms by sediment pulse to the stream channel would be mitigated by following the Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources (ODFW 2008).

Indicator: Fish and aquatic habitat

Measure: large wood, pools, stream banks

There would be no direct effect to fish habitat by removing or replacing culverts. Where undersized culverts are replaced with larger structures, habitat may be improved downstream. Stream simulation through the road crossing would improve habitat locally.

There would be an overall beneficial effect on indicator Water Quality and measure sediment and turbidity by installing properly sized and culverts at these locations. Short- and long-term benefits to fish and aquatic organisms is expected by improving connection to upstream habitat.

Road reconstruction in RHCAs
Reconstruction of roads in riparian areas would not alter stream or groundwater flow characteristics to the extent that it will impact the riparian area. Roads would be managed to minimize impact to water quality and fish and aquatic habitat. Road maintenance and drainage would prevent the influx of significant amounts of road sediment runoff into stream courses.

There would be no direct effect to fish and aquatic organisms from road reconstruction, except where a road stream crossing is installed, replaced, or removed (discussed above).

Alternative 2 would have 11 miles of road reconstruction within RHCAs and Alternative 3 would have 1 mile of road reconstruction in RHCAs. Currently closed roads would be reopened to access harvest units or for log truck hauling and heaving equipment mobilization. Closed roads that would be opened for hauling activities located within Category 1, 2, and 4 RHCAs would adhere to PDC designed to minimize impacts to water quality, fish, and fish habitat.

The actions associated with opening and reconstructing closed roads as well as traffic on closed roads associated with mobilizing equipment and log haul could have indirect effects on water quality and fish habitat at stream crossings and where roads are located adjacent to channels. The amount of sediment entering stream channels depends on how close the road is to the channel,

the size of the riparian buffer between the road and stream channel, the slope, and how much downed wood is on the ground that could capture sediment.

According to the Hydrology report, overland sediment sediment entering stream channels from these activities would be immeasurable. Therefore, there are no effects to water quality or fish habitat indicators or associated measures from road reconstruction in Alternative 2 or 3.

ROAD CLOSURES

Alternative 2 and 3 would have 3.45 miles of roads currently open become closed. Approximately .4 miles of road that are in Category 1 and 4 RHCAs would be closed; .3 miles in Category 1 RHCAs and .1 in Category 4 RHCAs. Vegetation would be able to reestablish in these RHCAs because regular maintenance that includes brushing would not occur on these roads. This could stabilize slopes and increase shade production. This is a small amount of road miles compared to total road miles in RHCAs in the project area, however, there would likely be some beneficial effect to function of riparian areas in these locations. Closing these roads reduces potential sediment into channels from roads located in RHCAs.

Due to the small amount of road miles that would be closed, effects would be small and no measurable change to indicators or measures would occur.

Cumulative Effects

The cumulative effects analysis area for aquatic resources is the same as the analysis area used for the direct and indirect effects analysis. Past, present, and foreseeable future projects that overlap in time and space and could influence indicators in this analysis are livestock grazing and continued stream and floodplain restoration projects (Sheep restoration and stewardship project).

Activities that pose a risk of cumulative effects (adverse or beneficial) are discussed in this section. Cumulative effects risk is rated as:

- Low – insignificant or discountable cumulative effects on aquatic habitat may occur. Insignificant effects are defined as effects that a person, based on professional judgment, would not be able to meaningfully measure, detect, or evaluate. Discountable effects are those that are extremely unlikely to occur.
- Moderate – insignificant cumulative effects on aquatic habitat are likely to occur. A moderate rating assumes potential effects on habitat. The level of effects will not result in measurable changes in survival rates or population levels of aquatic species with special management status (i.e. ESA-listed, MIS, or Sensitive).
- High – measurable cumulative effects on aquatic habitat are likely to occur. Measurable effects are likely to result in changes in survival rates and population levels of aquatic species with special management status (i.e. ESA-listed, MIS, or Sensitive). A high rating assumes obvious adverse effects on habitat and aquatic species with special management status.

Livestock grazing is an ongoing management activity in the project area. Exclosure fences protect several miles of sensitive habitat including ESA listed fish habitat and the floodplain or meadows surrounding it. Sheep Creek, Chicken Creek, West Chicken Creeks, and Dry Creek met bank stability RMOs in 2019 stream surveys. This means that these streambanks on fishbearing

streams are not being actively trampled and the channel is not being actively over widened as a result. Grazing will continue to occur and impact some vulnerable areas such as wet meadow and Category 1, 2, and 4 channels and floodplains. Effects from the Sheep Creek Allotment Management Plan was analyzed and BO from USFWS was signed in 2013. Cumulative effects from livestock grazing and activities in alternatives 2 and 3 would be low since the effects to indicators and measures have only short-term direct effects to water quality (road stream crossings) and no measurable effects from vegetation treatments in RHCAs.

The second project that overlaps with this project is Sheep Restoration and Stewardship Project. This project would benefit fish and aquatic habitat and water quality. Indicators and measures will continue to trend in a positive trajectory. Cumulative beneficial effects are expected in alternatives 2 and 3 by improving fish passage barriers, thinning 36 acres to improve meadow habitat, and increasing rate of growth of trees in RHCAs by thinning understory. There is no risk posed to fish and aquatic habitat from cumulative effects of activities in alternatives 2 and 3 and stream and floodplain restoration work on Sheep Creek.

MIS Effects Analysis

Fish habitat in the analysis area meets the majority of PACFISH/INFISH RMOs for pool frequency, LWD, width to depth ratios, stream temperature and fine sediment. (see Fish and Aquatic Habitat Existing Conditions report).

In alternative 2, and 3, short term increase in fine sediment in stream channels would occur because of culvert installation, removal, and replacement activities. The predicted increases, however, would be short term and local and elevated sediment levels and increase in turbidity would be mitigated by conducting these activities when flows are low. Best management practices as well as project level PDCs (described above) would limit effects to water quality and fish habitat.

Fine sediment entering stream channels would decrease when road maintenance activities are complete. Long-term reduction entering stream channels is expected to be reduced by upgrading and maintaining roads associated with this project. The proposed action would also improve vegetative conditions and maintain the natural fire regime in the long-term in the project area. Activities proposed in alternatives 2 and 3 would not contribute to a negative trend in viability of redband trout or steelhead on the Wallowa-Whitman National Forest for redband trout.

Implementation of alternative 2 or 3 may impact water quality (short term increase in turbidity/sediment) and therefore redband trout or steelhead individuals but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

Aquatic Biological Evaluation

Proposed, Endangered, Threatened and Sensitive Aquatic Species

There are three ESA listed fish species in the project area: Columbia River Basin Bull Trout, Snake River Basin Steelhead, and Spring/summer Snake River Basin Chinook. Section 7 ESA consultation will occur with US Fish and Wildlife Service and National Marine Fisheries Service.

There are two confirmed and one suspected Regional Forester sensitive species in the analysis area (Table 3). Redband trout and pacific lamprey are confirmed and western ridged mussels are suspected. The Sheep project ***May Impact Individual redband trout and their Habitat*** (MIIH), in very localized locations where instream work would occur at road stream crossings but will not likely contribute toward federal listing or loss of viability to the population or species and ***May Impact Individual western ridge mussels and their Habitat*** (MIIH) in very localized locations where instream work would occur at road stream crossings, but will not likely contribute toward federal listing or loss of viability to the population or species. .

Redband Trout (Region 6 Sensitive Species, Wallowa-Whitman NF Management Indicator Species)

Redband trout, the resident form of *Oncorhynchus mykiss,* are a Region 6 sensitive species in addition to a WWNF management indicator species. Redband trout are widely distributed in the Sheep project area and occupy all Category 1 streams: approximately 27.3 miles of habitat.

Life History

Redband trout are sensitive to changes in water quality and habitat. Adult redband trout are generally associated with pool habitats, although various life stages require a wide array of habitats for rearing, hiding, feeding, and resting. Pool habitat functions as important refugia during low water periods. An increase in sediment lowers spawning success and reduces the quantity and quality of pool and interstitial habitat. Other important habitat features include healthy riparian vegetation, undercut banks and LWD.

Redband trout generally spawn during the March through May timeframe. Redband redds tend to be located where velocity, depth and bottom configuration induce water flow through the stream substrate, often in gravels at the tail out area of pools. Eggs incubate during the spring and emergence occurs from June through July depending on water temperatures. Redband trout may reside in their natal stream or may migrate to other streams within a watershed to rear.

Abundance in Analysis Area

Abundance surveys for redband trout have not occurred in the Sheep Creek or Chicken Creek subwatersheds. Their abundance is not known.

Effects of the Alternatives

Alternative 1

Alternative 1 of the Sheep Project ***May Impact Individual redband trout and their Habitat*** but will not likely contribute toward federal listing or loss of viability to the population or species (MIIH).

Watershed and aquatic habitat conditions would likely remain in their current condition for the next 5 years. Most of the timbered stands in the project area would be represented by fuel models that are likely to exhibit moderate to severe fire severities in the case of a wildfire. Wildfires typically result in increases in fine sediment for three to five years, depending on the wildfire

severity (Neary et al., 2005). Adverse impacts to aquatic habitat would likely occur where fine sediment levels exceed the 20% threshold. These levels would likely decrease spawning success for redband trout, and a decrease survival of juvenile salmonids may occur. Increases in stream temperatures can last longer depending on the severity of fire in riparian areas. If water temperatures exceed 64^{o}F for extended periods because of wildfire survival of redband trout would likely be reduced.

Alternatives 2, and 3
Alternatives 2 and 3 of the Sheep Project ***May Impact Individual redband trout and their Habitat*** (MIIH) but will not likely contribute toward federal listing or loss of viability to the population or species. Impacts to redband trout may result from short-term increases in fine sediment at road stream crossing activities and up to .5 miles downstream). This would be short term. Improvement of drainage features is expected to decrease sediment inputs over time (long term effects).

Alternatives 2, and 3 are expected to improve the natural fire regime in the long-term and improve conditions of riparian vegetation in the meadow restoration unit. This long-term outcome is expected to have beneficial impacts to redband trout and their habitat in the analysis area.

Cumulative Effects

There is a low risk of cumulative effects to redband trout habitat from the proposed activities in alternative 2 or 3 and grazing activities in the Sheep analysis area. Grazing, where livestock has access to streams can also cause streambank stress and bank sheer and over widening of streambanks and can impact riparian vegetation. This can decrease shade and increase solar radiation and therefore increase stream temperature. Effects from grazing is minimized by adhering to PACFISH/INFISH Standards and Guidelines for grazing activities and WWNF Forest Plan standards and guidelines for utilization. Since there would be no effect on stream temperature from vegetation treatments in alternative 2 or 3, no cumulative effect would occur from the overlap in time and space of these two activities.

Sheep Restoration and Stewardship project would have beneficial effects to fish and aquatic habitat. There is no risk from cumulative effects from these two projects. Thinning to achieve objectives of a diverse and resilient condition for RHCA vegetation as well as removal and replacement of road crossings on fish bearing streams to improve passage to upstream habitat would result in a cumulative beneficial effect.

Pacific Lamprey (Region 6 Sensitive Species)

Pacific Lamprey (*Entosphenus tridentatus*) are widely disributed betweek California and Alaska (Lamprey Technical Work Group, 2020). Adult Pacific Lamprey have been translocated into Sheep Creek in 2018 and 2019. They have been observed spawning and their redds have been identified in Sheep Creek in 2019 and 2020.

Habitat and Distribution

Larval and juvenile Pacific Lamprey burrow into fine sediments in depositional areas along stream margins, that have slower water velocities. Adults depend on large cobble, boulders, and bedrock and large wood that create deep, slow water where pre-spawning adults can hold (Lamprey Technical Work Group, 2020). Adult Pacific Lamprey have also been found burrowed in loose sand. Quality spawning habitat includes low gradient pool tail-outs and deeper riffles with diverse substrate (Gunkel et al. 2009).

Distribution in the project area has only been confirmed in Sheep Creek and that is the only location where adults were released and redds were identified in the project area. There have been no surveys or data collection for juveniles in the project area.

Abundance in Analysis Area

Abundance in the Sheep project area is not known.

Effects of the Alternatives

Alternative 1

Alternative 1 of the Sheep Project will have ***No Impact on Individual Pacific Lamprey and their Habitat*** (NI), Watershed and aquatic habitat conditions would likely remain in their current condition for the next 5 years.

Alternatives 2 and 3

Alternatives 2 and 3 of the Sheep Project ***May Impact Individual Pacific Lamprey and their Habitat*** (MIIH) but will not likely contribute toward federal listing or loss of viability to the population or species. Impacts to Pacific Lamprey may occur because of short-term increases in turbidity from fine sediment (see effects Road Related Activities section) particularly if larva or juveniles are burrowed in sediment that is within .5 miles downstream of culvert replacements.

Impacts from activities proposed under Alternatives 2 and 3 are unlikely to result in degradation of habitat for Lamprey. Increases in fine sediment are expected to be minimal and short term and within habitat tolerances for Pacific Lamprey.

Under Alternative 2 and 3, the only short-term potential measurable increases in fine sediment in aquatic habitat would likely occur in the vicinity of culvert replacement and installation/removal of temporary culverts or in areas where road relocation or reconstruction occurs near stream channels.

Overall, a decrease in erosion from road surfaces is expected because of the proposed road improvements and relocations in both action alternatives. Both Alternatives would also maintain a more natural fire regime in the long-term in the project area. Both long-term outcomes would have beneficial impacts to western ridge mussels and their habitat in the analysis area. Commercial and non-commercial thinning activities would occur in RHCAs under Alternative 2. These activities would leave a minimum of one site potential tree height no activity buffer. Mechanical equipment would enter RHCAs, therefore, increases in sediment to channels could occur. In addition, temporary roads constructed in RHCAs as well as 16 road crossings in Category 4 RHCAs could contribute to sedimentation in stream channels.

Cumulative Effects

Due to limited mobility of juvenile life stage of pacific lamprey, there is a moderate risk of cumulative effects to juveniles proposed activities (culvert replacements and removals), which would be short term, and ongoing road maintenance and grazing activities in the analysis area. Both activities can result in increases in fine sediment in aquatic habitat. Increases in fine sediment can reduce reproductive success and overall fitness of pacific lamprey. However, since project activities are not anticipated to contribute measurable increase in fine sediment, even in the short term, it is very unlikely that project activities would lead to a cumulative effect. There has also been significant investment in erecting livestock exclosure fence to protect meadow, low gradient, sensitive areas from livestock grazing in the project area.

For ongoing road maintenance activities, short-term effects from road maintenance activities are minimized by following PACFISH/INFISH standards and guidelines, and road maintenance BMPs (USDA 2012). In the long-term, road maintenance activities reduce adverse effects to aquatic habitat by correcting drainage patterns crossing roads and reducing overall erosion rates from the road system.

For grazing activities, the potential cumulative effects are minimized by adhering to PACFISH/INFISH Standards and Guidelines for grazing activities, WWNF Forest Plan standards and guidelines for utilization and terms and conditions outlined in Biological Opinion ESA consultation for ESA-listed species in the project area.

Western Ridged Mussel (Region 6 Sensitive Species)

Western ridged mussels were designated a Region 6 Forester's Sensitive Species during the development of the 2008 and 2015 R6 Sensitive Species List. Initially, western ridge mussels were suspected to be present on the Wallowa-Whitman NF based a review of occurrence records. Additional record reviews and data searches by WWNF personnel revealed that western ridged mussels were historically present in large numbers in the Snake River and confirmed that western ridge mussels are currently present in the Snake River, Hells Canyon portion, on the Hells Canyon NRA. The current Snake River western ridge mussel population is suspected to be at very low levels compared to pre-European settlement. Relic shells of western ridge mussels were collected by personnel from the Wallowa Mountains Office of the WWNF during a monitoring trip on the Hells Canyon portion of the Snake River in October of 2010. Western ridge mussels were also documented in the Powder River (1963) and Grande Ronde River (pre-1929) downstream of the WWNF.

Habitat and Distribution

Western ridge mussels occur in streams of all sizes but are rarely found in lakes or reservoirs. They are found mainly in low to mid-elevation watersheds, and do not often inhabit high elevation headwater streams where western pearlshells are found. They often share habitat with *Margaritifera falcata* (western pearlshell mussel) throughout much of the Pacific Northwest. They inhabit mud, sand, gravel, and cobble substrates. Western ridge mussels are more tolerant of fine sediments than western pearlshells and occupy depositional habitats and banks. They can withstand moderate amounts of sedimentation but are usually absent from habitats with highly unstable or very soft substrates. Cursory evidence suggests that western ridged mussels are more pollution-tolerant than other native mussels.

Habitat for western ridge mussels appears to have broad environmental gradients. In the John Day system western ridge mussels are more abundant in the mid and lower reaches of the M.F. and N.F. John Day Rivers compared to western pearlshell mussels (Brim Box et al., 2006). Habitat in the middle reaches of these streams is warmer and has higher levels of fine sediment compared to the upper reaches. In the Salmon River, Vannote and Minshall (1982) found western pearlshell mussels being replaced by western ridge mussels where fine sediment had increased because of timber management activities in the watershed.

Threats to western ridge mussels and other species of freshwater mussels include loss of host fish, introduction of non-native fish, dams, channel modification from channelization and suction dredge mining, thermal pollution, chemical pollution, sedimentation and siltation from silvicultural and agricultural practices, water withdrawal and diversion, and livestock grazing in riparian areas. Since western ridge mussels require stable habitats, they may be particularly threatened by dewatering and other activities that cause shifting substrates, water level fluctuations, and seasonal hypoxia or anoxia. Species that live for 20-30 years, as has been suggested for western ridge mussels, often appear to have healthy populations, when only the older adults may be withstanding environmental changes and the population may no longer be reproducing.

Abundance in Analysis Area

The presence of western ridge mussels is suspected on the WWNF but has not been confirmed and therefore has not been confirmed in the analysis area.

Effects of the Alternatives

Alternative 1

Alternative 1 of the Sheep Project will have ***No Impact on Individual western ridge mussels and their Habitat*** (NI), Watershed and aquatic habitat conditions would likely remain in their current condition for the next 5 years. Current aquatic habitat conditions in the analysis area are not likely limiting for western ridge mussels.

Most of the timbered stands in the project area are represented by fuel models that are likely to exhibit moderate to severe fire severities in the case of a wildfire. Wildfires typically result in increases in fine sediment for three to five years, depending on the wildfire severity (Neary et al., 2005). Western ridge mussels would be vulnerable to impacts from large-scale wildfires that result in large increases in fine sediment and changes in peak flows. Western ridge mussels are adapted to habitats with fine sediment; however, large influxes of fine sediment could result in the burying of mussel beds and the death of individuals. Western ridge mussels require stable streambeds for mussel beds to develop. Increases in peak flows that scour streambed substrates destroy existing mussel beds.

Alternatives 2 and 3

Alternatives 2 and 3 of the Sheep Project ***May Impact Individual western ridge mussels and their Habitat*** (MIIH) but will not likely contribute toward federal listing or loss of viability to the population or species. Impacts to western ridged mussels may occur because of short-term increases in turbidity from fine sediment pulses (see effects Vegetation Treatments and Road Related Activities section).

Current levels of fine sediment in the six streams where substrate/particle size information was collected and analyzed indicate high levels of fines at channel cross sections where these measurements were taken. In these areas short-term potential increases in fine sediment from proposed prescribed burning, thinning, and transportation system activities are unlikely to result in measurable, long term increases in fine sediment in streams in the analysis area.

Impacts from activities proposed under Alternatives 2 and 3 are unlikely to result in degradation of habitat for western ridge mussels. Increases in fine sediment are expected to be minimal and short term and within habitat tolerances for western ridge mussels.

Under Alternative 2 and 3, the only short-term potential measurable increases in fine sediment in aquatic habitat would likely occur in the vicinity of culvert replacement and installation/removal of temporary culverts or in areas where road relocation or reconstruction occurs near stream channels.

Overall, a decrease in erosion from road surfaces is expected because of the proposed road improvements and relocations in both action alternatives. Both Alternatives would also maintain

a more natural fire regime in the long-term in the project area. Both long-term outcomes would have beneficial impacts to western ridge mussels and their habitat in the analysis area.

Cumulative Effects

Due to their lack of mobility, there is a moderate risk of cumulative effects to western ridge mussel habitat from the proposed activities and ongoing road maintenance and grazing activities in the analysis area. Both activities can result in increases in fine sediment in aquatic habitat. Increases in fine sediment can reduce reproductive success and overall fitness of western ridge mussels. However, since project activities are not anticipated to contribute measurable increase in fine sediment, even in the short term, it is very unlikely that project activities would lead to a cumulative effect. There has also been significant investment in erecting livestock exclosure fence to protect meadow, low gradient, sensitive areas from livestock grazing in the project area.

For ongoing road maintenance activities, short-term effects from road maintenance activities are minimized by following PACFISH/INFISH standards and guidelines, and road maintenance BMPs. In the long-term, road maintenance activities reduce adverse effects to aquatic habitat by correcting drainage patterns and roadbeds and reducing overall erosion rates from the road system.

For grazing activities, the potential cumulative effects are minimized by adhering to PACFISH/INFISH Standards and Guidelines for grazing activities and WWNF Forest Plan standards and guidelines for utilization.

Literature Cited

Bilby, R. E. and J. W. Ward. 1991. Characteristics and function of large woody debris in streams draining old-growth, clear-cut, and second-growth forests in southwestern Washington. Canadian Journal of Fisheries and Aquatic Sciences 48: 2499-2508

Bilby, R. E., K. Sullivan, S.H. Duncan. 1989. The generation and fate of road-surface sediment in forested watersheds in southwestern Washington. Forest Science. Vol 35 (2): 453-468.

Brim Box, J., J. Howard, D. Wolf, C. O'Brian, D. Nez and D. Close. 2006. Freshwater Mussels (Bivalvia: Unionoida) of the Umatilla and Middle Fork John Day Rivers in Eastern Oregon. Northwest Science 80:95-107.

Decker, R. C. 2003. Current Regulations, Guidelines and Best Management Practices Concerning Forest Harvesting and Riparian Zone Management. Fisheries and Oceans Canada Science, Oceans and Environment Branch Environmental Sciences Section. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.621.8555&rep=rep1&type=pdf

Duncan, S.H., R. E. Bilby, J.W. Ward, J. T. Heffner. 1987. Transport of road-surface sediment through ephemeral stream channels. Journal of the American Resources Association. Vol 23 (1): 113-119.

Foltz, R. B., K. A. Yanosek, and T. M. Brown. 2008. Sediment concentration and turbidity changes during culvert removals. Journal of Environmental Management 87(329-340).

Frissell, C.A., R.J. Baker, D.A. DellaSala, R.M. Hughes, J.R. Karr, D. A. McCullough, R.K.Nawa, J. Rhodes, M.C. Scurlock, and R.C. Wissmar. 2014. Conservation of aquatic and fishery resources in the Pacific Northwest: Implications of new science for the aquatic conservation strategy of the Northwest Forest Plan. Report prepared for the Coast Range Association, Corvallis, OR. 35 p. http://coastrange.org.

Homyak, J. A., Harrison, D. J., and W. B. Krohn. 2004. Structural differences between precommercially thinned and unthinned conifer stands. Forest Ecology and Management, 194, 131-143.

Jakober, M. J. 2002. Sheep Creek culvert replacement sediment monitoring. *In:* Foltz, R. B., K. A. Yanosek, and T. M. Brown. 2007. Journal of Environmental Management. 87 (2008) 329-340.

Lachance, S., M. Dube, R. Dostie, P, Berube. 2008. Temporal and spatial quantification of fine-sediment accumulation downstream culverts in brook trout habitat. Transactions of the American Fisheries Society. Vol 137 (6): 1826-1838.

(Lamprey Technical Work Group, 2020).

Neary, Daniel G.; Ryan, Kevin C.; DeBano, Leonard F., eds. 2005. Wildland fire in ecosystems: effects of fire on soils and water. Gen. Tech. Rep. RMRS-GTR-42-vol.4. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 250 p. (http://www.fs.fed.us/rm/pubs/rmrs_gtr042_4.html)

ODFW. 2008. Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources.

Pollock, M.M. and T.J. Beechie. 2014. Does riparian forest thinning enhance biodiversity? The ecological importance of large wood. Journal of the American Water Resources Association 50(3):543-559. DOI: 10.1111/jawr.12206

Pothier, D. 2002. Twenty year results of pre-commercial thinning in a balsam fir stand. Forest Ecology Management. 168, 177-186.

Reeves, G., R. Pickard and K. Johnson. 2016. An initial evaluation of potential options for managing riparian reserves of the Aquatic Conservation Strategy of the Northwest Forest Plan. Gen. Tech. Rep. PNW-GTR-937. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 97 p.

Rentmeester, S. A. 2004. An assessment of large woody debris and riparian forest resources at Ellsworth Creek watershed and a comparison of riparian management options. MS. University of Washington, Seattle, WA.

Richards, D.C., C.M. Falter, G.T. Lester, and R. Myers. 2005. Responses to FERC additional information request AR-2. Listed mollusks. Hells Canyon Project FERC No. P-1971-079. Idaho Power Company.

Rieman, B., D. Lee. G. Chandler, and D. Myers. 1995. Does wildfire threaten extinction for salmonids? Responses of redband trout and bull trout following recent large fires on the Boise National Forest. Proceedings of Fire Effects on Rare and Endangered Species and Habitat Conference, November 13-16, 1995, Courd' Alene, Idaho.

National Marine Fisheries Service. 2000. Northwest Region, Protected Resources Division in Portland, Oregon. (http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d Rules/upload/electro2000.pdf).

Spies, T., M. Pollock, G. Reeves, and T. Beechie. 2013. Effects of riparian thinning on wood recruitment: A scientific synthesis. Science Review Team, Wood Recruitment Subgroup, Forestry Sciences Laboratory, Corvallis, OR, and NW Fisheries Science Center, Seattle, WA. January 28. 46 p.

USDA Forest Service. 1990. Wallowa-Whitman National Forest Land and Resource Management Plan. Baker City, Oregon.

USDA and USDI. 1995. Environmental Assessment for the Implementation of Interim Strategies for Native Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California. Washington, D.C.

USDA The Range-Wide Bull Trout eDNA Project – USFS RMRS https://usfs.maps.arcgis.com/apps/webappviewer/index.html?id=6d5597b2755c4c00a35613b7a1849760 (05/13/2021)

Vannote, R.L., and G.W. Minshall. 1982. Fluvial processes and local lithology controlling abundance, structure, and composition of mussel beds. *Proceedings of the National Academy of Sciences* 79:4103-4107.

Wondzell, S.M., M. Diabat, and R. Haggerty. 2019. What matters most: Are future stream temperatures more sensitive to changing air temperatures, discharge, or riparian vegetation? Journal of the American Water Resources Association. 55(1): 116-132. https://doi.org/10.1111/1752-1688.12707.